White River TMDL

Technical Memorandum No. 3A (DRAFT)

To: *Staci Goodwin and Jennifer Hutchison - IDEM*
From: *Gary Mercer and Chris Ranck - CDM*

Date: *June 12, 2003*

Subject: *White River TMDL*
Watershed Improvement Scenarios

Introduction

The State of Indiana assesses its water bodies for compliance with water quality standards criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into three categories, supporting, partially supporting, or not supporting their designated uses depending on water quality assessment results. These water bodies are found on Indiana's 305(b) list as required by that section of the CWA that defines the assessment process, and are published every two years.

Some of the 305(b) partially and not supporting water bodies are also assigned to Indiana's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in-stream water quality conditions. This allows water quality based controls to be developed to reduce pollution and restore and maintain water quality.

Water quality data was collected from the West Fork White River in Marion County and south to Waverly. In 1998, the Indiana Department of Environmental Management (IDEM) determined that the river does not comply with the following water quality standards:

- *E. coli* bacteria
- Cyanide
- Dissolved Oxygen

As a result, this portion of the White River was added to the state's 303(d) list and scheduled for a TMDL evaluation.

Cyanide and DO Source Assessment and Load Characterization

An earlier analysis indicated that the primary source of cyanide is the city's advanced wastewater treatment plants (AWTs) at Belmont and Southport. The instream water quality monitoring data supports this finding. Hence, control of cyanide is primarily a NPDES permit question associated with the AWTs

Low dissolved oxygen that does not meet the instream water quality standards is caused by CSO discharges. The city's CSO Long-term Control Plan is being developed to reduce or eliminate the occurrence of dissolved oxygen below standard.

Ammonia Source Assessment and Load Characterization

During data analysis, it was determined that the data did not support a need for a TMDL on the White River for Ammonia. A request by the City of Indianapolis to remove the West Fork of White River for ammonia from the 303(d) list was reviewed and approved by IDEM. In IDEM's Summary Response to Comments submitted March 1 to May 29, 2002, IDEM states, "IDEM re-evaluated these listings in light of the data submitted by the City of Indianapolis, Department of Public Works. IDEM will recommend that the West Fork of the White River from the confluence of Fall Creek to the confluence of Pleasant Run be delisted for ammonia." A check against the new 303(d) list verifies that White River is not listed as impaired for ammonia.

Based on the above, this technical memorandum will focus on the source assessment and load characterization of *E. coli* bacteria.

E. coli Bacteria Source Assessment and Load Characterization

Technical Memorandum 2A documented the source assessment that characterizes the known and suspected sources of *E. coli* bacteria in the watershed for use in the water quality model, and the development of the TMDL. There are two NPDES wastewater treatment facilities on the White River, the Belmont and Southport AWT plants, which both discharge *E. coli* bacteria.

E. coli bacteria for this TMDL was characterized for the following sources:

- Septic systems
- Illicit connections to storm drains
- Advanced wastewater treatment plants

- Wildlife/Natural
- Stormwater runoff
- Combined sewer overflows
- Upstream sources

All sources of *E. coli* bacteria identified in the watershed are assigned a loading rate based on data from the City of Indianapolis, literature values and population in the watershed. Because of varying decay or die-off rates for *E. coli* bacteria, and varying transport assumptions, the *E. coli* bacteria loading from these sources are computed separately in the model as described in Technical Memorandum 2A.

Description of Daily *E. coli* Bacteria Model

A comprehensive model of the White River from Marion County downstream to Waverly was developed and calibrated to the existing instream *E. coli* bacteria data. The model simulated the daily instream bacteria counts for each stream segment based on loads from the sources described above. For the dry weather sources, a constant load was applied, whereas for stormwater runoff and CSO discharges, the *E. coli* bacteria load was based on the city's watershed model (for stormwater) and collection system model (for CSO discharges). A ten year period of time (October 1991 through September 2001) was simulated. Data on stream flow was used to predict the resultant instream *E. coli* bacteria counts for each day for the ten year period.

Daily flow data for the White River – Indianapolis and at Stout was obtained from the USGS for the period of October 1, 1991 through September 30, 2001. Daily flow data was used for the daily *E. coli* model.

The White River was divided into three segments for analysis purposes:

- White River North -- Upstream Marion County line to Lake Indy
- White River CSO -- Lake Indy to Tibbs/Banta
- White River South -- Tibbs/Banta to Waverly

The table on the next page lists the load reduction scenarios that were evaluated using the daily *E. coli* bacteria model. These scenarios are representative of the current and future watershed programs being pursued by the City of Indianapolis. Although it is not an element of the city's programs, all scenarios have assumed that White River at the Hamilton County boundary will not exceed the 125 cfu/ 100 ml monthly geometric mean standard. A TMDL is currently underway for the White River in Hamilton County that will address the upstream sources of E. coli bacteria. The city's current stormwater NPDES Permit program is assumed to reduce the stormwater *E. coli* bacteria load by 10 percent. [The validity of this assumption is being checked by AMEC, the city's stormwater consultant.]

Reach	White River North	White River within CSO Area	White River South
Scenario #1	Hamilton County at Standard (125 cfu/100 ml)	Hamilton County at Standard (125 cfu/100 ml)	Hamilton County at Standard (125 cfu/100 ml)
Scenario #2	Hamilton County at Standard, Illicit Connections Removed, and Stormwater Reduction per NPDES Permit program	Hamilton County at Standard, Illicit Connections Removed, and Stormwater Reduction per NPDES Permit program	Hamilton County at Standard, Illicit Connections Removed, and Stormwater Reduction per NPDES Permit program
Scenario #3	Hamilton County at Standard, Illicit Connections Removed, Stormwater Reduction, and all Barrett Law Septics Removed	Hamilton County at Standard, Illicit Connections Removed, Stormwater Reduction, and all Barrett Law Septics Removed	Hamilton County at Standard, Illicit Connections Removed, Stormwater Reduction, and all Barrett Law Septics Removed
Scenario #4	Hamilton County at Standard, Illicit Connections Removed, Stormwater Reduction, Septics Removed, and CSO Control per the Draft 2001 LTCP	Hamilton County at Standard, Illicit Connections Removed, Stormwater Reduction, Septics Removed, and CSO Control per the Draft 2001 LTCP	Hamilton County at Standard, Illicit Connections Removed, Stormwater Reduction, Septics Removed, and CSO Control per the Draft 2001 LTCP

Findings of Simulated Scenarios

Table 1 contains a summary of the performance of the control scenarios compared with TMDL targets of 125 cfu/100 ml for monthly geometric mean, percent of days with *E. coli* bacteria above 235 cfu/100 ml, and number of days per year with *E. coli* bacteria above 10,000 cfu/100 ml. The findings show that all three targets can be met under dry weather flow conditions upstream and within the CSO area by the removal of failing septic systems and illicit sanitary connections. The findings also show that significant reductions in wet weather *E. coli* bacteria can be achieved by stormwater and CSO controls. **Figures 1-9** contain plots of the TMDL targets for all White River scenarios.

The allowable TMDLs for the White River are presented below. Additional controls beyond the presented scenarios may be necessary to achieve the TMDL.

- White River North -- **1.04 x 10^{12} cfu**, which requires an 82% reduction in the average daily bacteria load.

- White River CSO area -- **1.20x 10^{12} cfu**, which requires a 99.7% required reduction in the average daily bacteria load.

- White River South --**1.49x 10^{12} cfu**, which requires a 99.7% reduction in the average daily bacteria load.

cc: Lara Daly, City
John Chavez, City
Paul Werderitch, City
Robin Garibay, Advent Group
Robert Barr, Clean Stream Team
Mark Burgess, CDM
Srini Vallabhaneni, CDM

TABLE 1: EFFECTS OF WATERSHED IMPROVEMENT SCENARIOS
WHITE RIVER

Scenario	Geometric Mean of *E. coli* bacteria			% of Days *E. coli* bacteria > 235 cfu/100 ml			# of Days per year *E. coli* bacteria > 10,000 cfu/100 ml			Additional Load Reduction Required to meet the allowable TMDL (cfu)***
	All	Dry*	Wet**	All	Dry*	Wet**	All	Dry*	Wet**	
TMDL Objectives	**125**			**10%**			**0**			
White River-North Existing	181	**73**	210	40%	**0%**	43%	**0**	**0**	**0**	4.72E+12
White River-North Scenario 1	160	**73**	182	34%	**0%**	37%	**0**	**0**	**0**	4.40E+12
White River-North Scenario 2	150	**73**	171	32%	**0%**	34%	**0**	**0**	**0**	3.94E+12
White River-North Scenario 3	142	**60**	163	29%	**0%**	32%	**0**	**0**	**0**	3.84E+12
White River-North Scenario 4	142	**60**	163	29%	**0%**	32%	**0**	**0**	**0**	3.84E+12
White River-CSO Existing	459	**113**	551	54%	19%	56%	37	**0**	37	4.37E+14
White River-CSO Scenario 1	419	**113**	499	51%	19%	53%	37	**0**	37	4.37E+14
White River-CSO Scenario 2	398	**113**	472	49%	19%	51%	37	**0**	37	4.36E+14
White River-CSO Scenario 3	379	**92**	454	47%	**6%**	50%	37	**0**	37	4.36E+14
White River-CSO Scenario 4	239	**91**	276	42%	**6%**	45%	12	**0**	12	1.42E+14
White River-South Existing	455	166	539	56%	33%	58%	35	**0**	35	4.39E+14
White River-South Scenario 1	427	166	503	54%	33%	55%	35	**0**	35	4.38E+14
White River-South Scenario 2	409	166	479	53%	33%	54%	35	**0**	35	4.37E+14
White River-South Scenario 3	392	147	463	50%	30%	52%	35	**0**	35	4.37E+14
White River-South Scenario 4	255	147	290	45%	30%	47%	12	**0**	12	1.44E+14

Note: *E. coli* counts below the TMDL Objective are in bold

*The Dry weather geometric mean, % of days over 235 cfu/100 ml, and # of days per year over 10,000 cfu/100 ml are calculated for dry weather days only

**The Wet weather geometric mean, % of days over 235 cfu/100 ml, and # of days per year over 10,000 cfu/100 ml are calculated for wet weather days only

***The TMDL for the White River North reach is 1.04x10^12 cfu
The TMDL for the White River CSO area is 1.20x10^12 cfu
The TMDL for the White River South reach is 1.49x10^12 cfu

Figure 1: White River North - *E. coli* Bacteria Geometric Mean

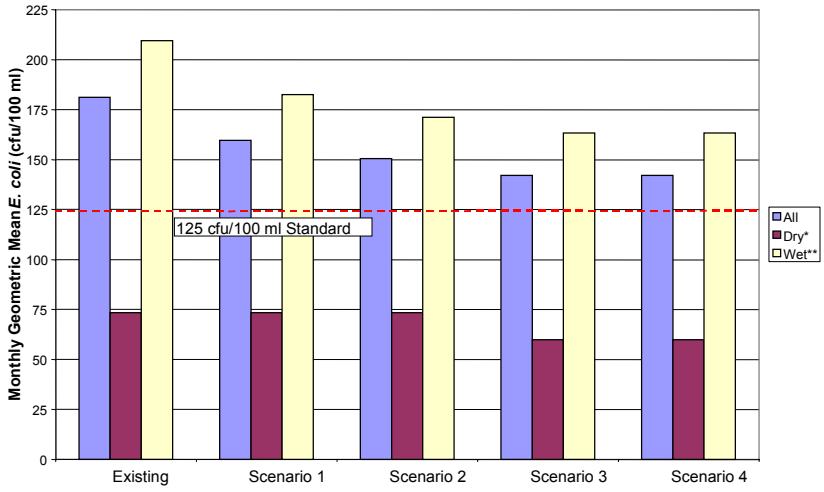

Figure 2: White River North - % of Days *E. coli* Bacteria > 235 cfu/100 ml

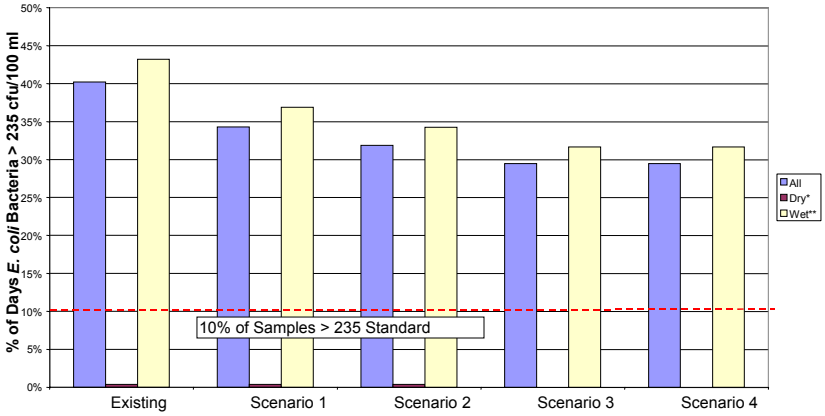

Figure 3: WR North - # of Days per year *E. coli* Bacteria > 10,000 cfu/100 ml

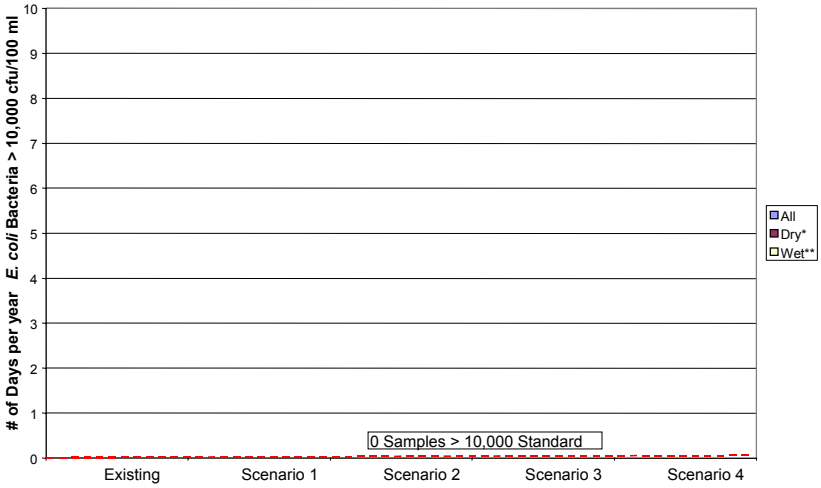

Figure 4: White River CSO Area - *E. coli* Bacteria Geometric Mean

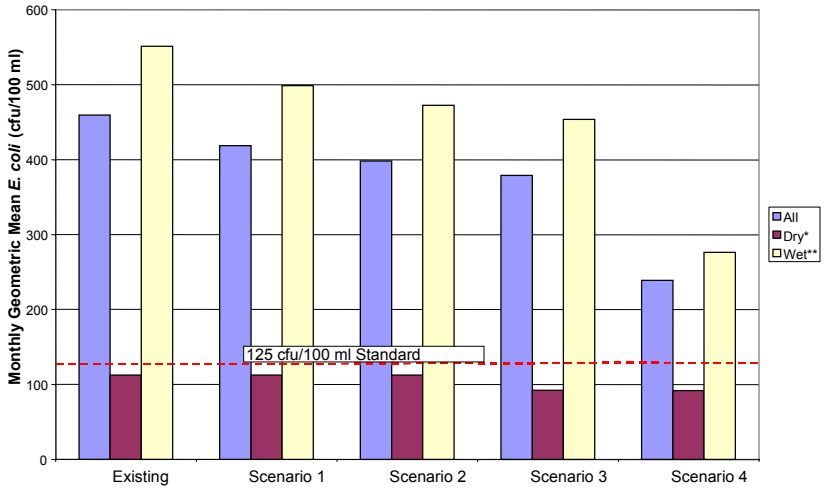

Figure 5: White River CSO Area - % of Days *E. coli* Bacteria > 235 cfu/100 ml

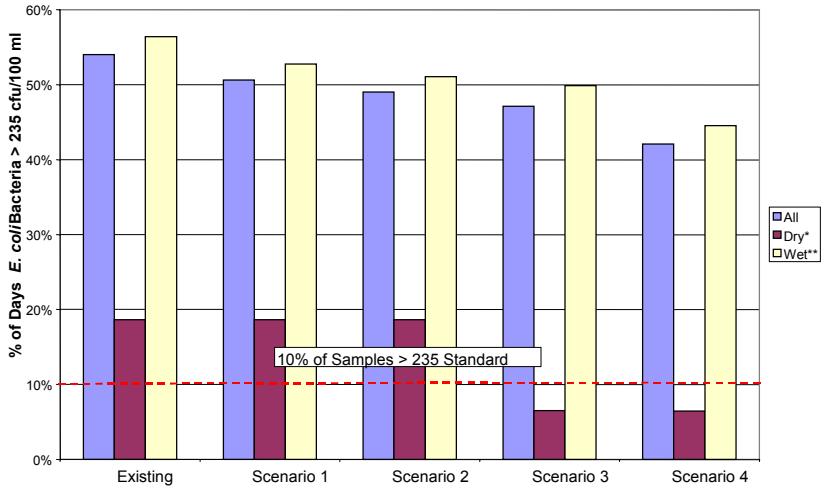

Figure 6: White River CSO Area - # of Days per year *E. coli* Bacteria > 10,000 cfu/100 ml

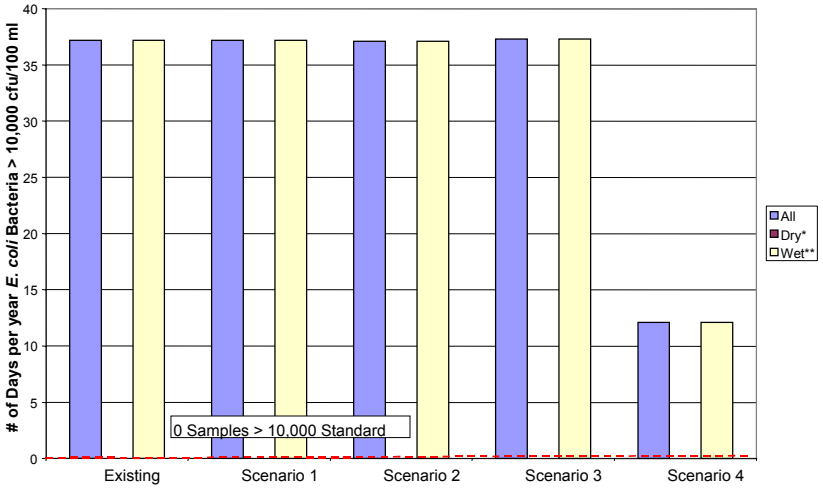

Figure 7: White River South - *E. coli* Bacteria Geometric Mean

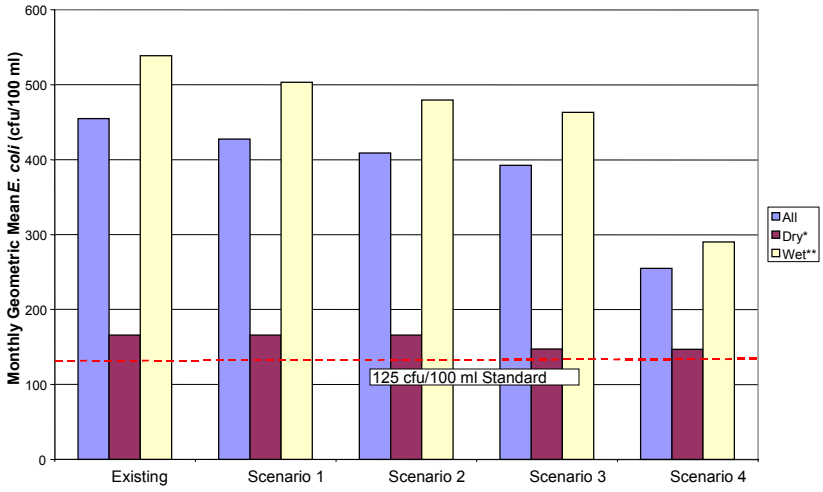

Figure 8: White River South - % of Days *E. coli* Bacteria > 235 cfu/100 ml

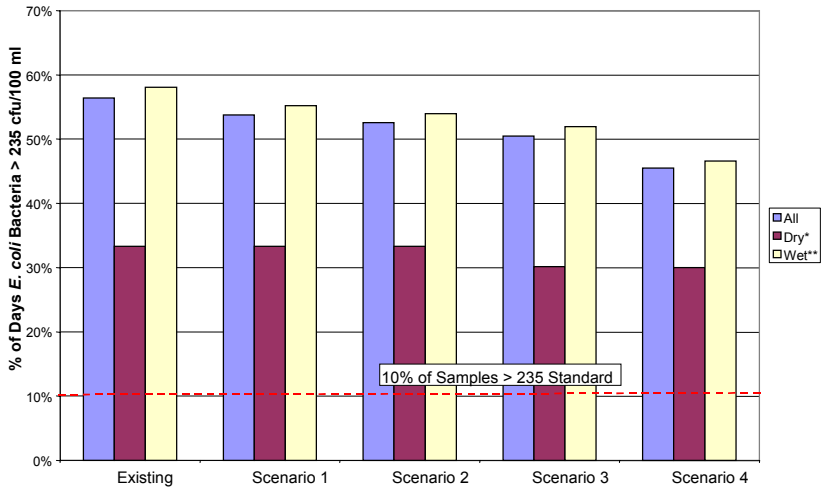

Figure 9: White River South - # of Days per year *E. coli* Bacteria > 10,000 cfu/100 ml